

**What is Claimed is:**

1. A thermal storage method wherein, if thermal storage temperature is  $T$ , variation in enthalpy in a chemical reaction is  $\Delta H$ , variation in entropy is  $\Delta S$ , and variation in free energy is  $\Delta G$ , a thermal storage material satisfying a relationship of

[Formula 2]

$$T\Delta S \geq \Delta G$$

is used under a condition of

[Formula 1]

$$\Delta H > 0$$

so as to promote a reaction for changing thermal storage material into thermal storage material in an energy storing state by adding supplemental energy when changing said thermal storage material into said thermal storage material in the energy storing state by decomposing or separating said thermal storage material.

2. The thermal storage method according to claim 1, wherein said supplemental energy is electricity, and to promote the reaction for changing said thermal storage material into said thermal storage material in the energy storing state by adding the supplemental energy is to promote the reaction for changing said thermal storage material into said thermal storage

material in the energy storing state by providing a potential difference.

3. The thermal storage method according to claim 1, wherein said supplemental energy is light, and to promote the reaction for changing said thermal storage material into said thermal storage material in the energy storing state by adding the supplemental energy is to promote the reaction for changing said thermal storage material into said thermal storage material in the energy storing state by a photocatalytic reaction.

4. The thermal storage method according to claim 2, wherein said thermal storage material and said thermal storage material in the energy storing state include a substance condensable or a substance storable by absorption and convertible to an ion-conducting substance.

5. The thermal storage method according to claim 4, wherein said ion-conducting substance is proton.

6. The thermal storage method according to claim 2, wherein said thermal storage material includes a substance for absorbing heat by a dehydrogenating reaction of O-H coupling and C-H coupling.

7. A thermal storage apparatus using the thermal storage method according to claim 1, comprising:

a heat source;

a supplemental energy supply portion of adding said supplemental energy;

a thermal storage reaction portion of changing said thermal storage material into said thermal storage material in the energy storing state by decomposing or separating said thermal storage material with heat from said heat source and said supplemental energy from said supplemental energy supply portion;

an energy storing thermal storage material storage portion of storing said thermal storage material in the energy storing state;

exothermic reaction portion of coupling said thermal storage material in the energy storing state; and

a heated fluid passage of receiving heat from said exothermic reaction portion.

8. The thermal storage apparatus according to claim 7, further comprising:

a heating fluid passage, having a part of it placed in said thermal storage reaction portion, of heating said thermal storage reaction portion with a heating fluid circulating inside it;

a thermal storage material storage portion of storing said thermal storage material,

wherein said heat source is said heating fluid passage; and

said heating fluid passage contacts with said thermal storage material storage portion more upstream side than said thermal storage reaction portion so as to heat said thermal storage material storage portion.

9. The thermal storage apparatus according to claim 7, comprising a heat exchanger between said energy storing thermal storage material storage portion and said thermal storage reaction portion or in said energy storing thermal storage material storage portion,

wherein said heat source is said heat exchanger; and

said heat exchanger recovers the heat of said thermal storage material in the energy storing state and heats said thermal storage material with said recovered heat.

10. The thermal storage apparatus according to claim 7, comprising a supplemental energy control portion of adjusting an amount of said supplemental energy correspondingly to change in temperature of said thermal storage reaction portion.

11. The thermal storage apparatus according to claim 7, wherein said supplemental energy is electricity;

said thermal storage reaction portion has electrodes and an electrolyte;

said supplemental energy supply portion adds a potential difference between said electrodes; and

said thermal storage reaction portion promotes said decomposition or separation reaction with said added potential difference.

12. The thermal storage apparatus according to claim 11, wherein said exothermic reaction portion has an electrode portion with a first electrode and a second electrode placed on both sides of the electrolyte and electric terminals connected to said first electrode and said second electrode, supplies at least one kind of said thermal storage material in the energy storing state to said first electrode and supplies other thermal storage material in the energy storing state to said second electrode, so that said thermal storage material in the energy storing state supplied to said first electrode is ionized and moves to said second electrode by way of said electrolyte to cause said electric terminals to generate electricity, and heated fluid of said heated fluid passage is heated by the heat generated on generating the thermal storage material on said second electrode.

13. The thermal storage apparatus according to claim 12, wherein said exothermic reaction portion doubles as said thermal storage reaction portion,

and said apparatus comprises switching means of switching said electric terminals so that said electric terminals are connected (1) to said supplemental energy supply portion when separating or decomposing said thermal storage material in said exothermic reaction portion and (2) to the electric terminals for taking out electricity when coupling said thermal storage material in the energy storing state in said exothermic reaction portion respectively.

14. The thermal storage apparatus according to claim 12, further comprising electricity storage means, connected to said electric terminals, of storing electricity generated on said electric terminals, and

said electricity storage means supplies the electricity to said thermal storage reaction portion via said supplemental energy supply portion so as to promote decomposition or separation of said thermal storage material.

15. The thermal storage apparatus according to claim 14, further comprising thermal storage reaction portion heating means of heating said thermal storage reaction portion by having the electricity supplied from said electricity storage

means on decomposing or separating said thermal storage material.

16. The thermal storage apparatus according to claim 12, further comprising electric heat conversion means connected to said electric terminals and placed to thermally contact said heated fluid passage, and

wherein said electric heat conversion means converts the electricity generated on generating coupling of said thermal storage material in the energy storing state into heat so as to heat said heated fluid passage.

17. The thermal storage apparatus according to claim 12, further comprising electric heat conversion means connected to said electric terminals and placed to thermally contact said energy storing thermal storage material storage portion, and

wherein said electric heat conversion means converts the electricity generated on generating coupling of said thermal storage material in the energy storing state into heat so as to heat said energy storing thermal storage material storage portion.

18. A heat source system, further comprising the thermal storage apparatus according to claim 16 or 17,

wherein said electric heat conversion means is a heat pump; and

said heat pump generates heat and cold from the electricity generated on generating coupling of said thermal storage material in the energy storing state, heats said heated fluid passage and/or said energy storing thermal storage material storage portion with said heat, and cools said energy storing thermal storage material storage portion with the cold.

19. A thermal storage method, comprising:

a thermal storage reaction step of generating a thermal storage material in an energy storing state by decomposing or separating a thermal storage material on a thermal storage reaction and heating said thermal storage material generating a reaction of said decomposition or separation and coupling so as to generate said decomposition or separation; and

an exothermic reaction step of coupling said thermal storage material in the energy storing state generated by said decomposition or separation, and

said exothermic reaction step supplies at least one kind of said thermal storage material in the energy storing state to a first electrode and supplies other said thermal storage material in the energy storing state to a second electrode of an exothermic reaction portion having an electrode portion with said first electrode and said second electrode placed

on both sides of the electrolyte, so that a further decomposed and ionized portion of said thermal storage material in the energy storing state moves to said second electrode side by way of the inside of said electrolyte film to cause electricity to be generated between said first electrode and said second electrode and generate said thermal storage material on said second electrode so as to generate heat.

20. The thermal storage apparatus according to claim 7, wherein the supplemental energy is light;

said thermal storage reaction portion has a light exposure surface; and

said supplemental energy supply portion supplies the light to said light exposure surface so as to promote the decomposition or separation.